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To overcome this limitation, shaped-beam- exposure tools have been developed which use two (or more) aligned, generally square, shaping apertures with a deflection arrangement there between. Thus a beam shaped by a first shaping aperture is caused to overlay (and be intercepted by) only a portion of the second shaping aperture in order to develop, for example, rectangular shapes of desired aspect ratios. Such a system, while avoiding mechanical movement of parts, presents problems of positioning since the shaped beam will be asymmetrically located with respect to the original beam and include stationary edges formed by the second shaping aperture and variable edges formed by the first aperture. Therefore, complementary deflection after shaping will result in the beam being off-axis. To avoid undue complication in achieving a desired positioning the beam at the target, a corner of the shaped beam formed by the second shaping aperture is used as a reference point.

Please replace the first full paragraph starting on page 5 line 19 with the following:

a2

Further, there is an additional class of lithographic exposures known as mask making (e.g. for making reticles for use in any optical, deep UV, extreme UV, electron-projection, ion-projection, and x-ray lithography tools), which does not allow for placement of registration targets on the workpiece or otherwise in the target plane. For this class of exposures, the pattern placement accuracy depends on a process known as emulation whereby the patterned substrate is characterized by an external metrology tool and the positional error information is fed back to the tool for subsequent exposures. This mode of operation is known as blind writing and the time between external measurement and subsequent corrected exposure may be measured in days.

Q2
End

This mode of operation only succeeds when the tool possesses extreme stability.

Please replace the first full paragraph starting on page 12, line 6 with the following:

Q3

It will be immediately apparent from a comparison of Figures 1 and 2 that the invention additionally includes a probe mesh 110 and a probe dither deflector 120. The probe mesh 110 is preferably a fine wire grid of metal or other material capable of absorbing or backscattering electrons emitted from electron source 10. (A contrast aperture 111 may be included to prevent scattered electrons from further interfering with the beam.) A lithographically produced pattern of, for example, gold on a thin silicon substrate is suitable for the practice of the invention, as are many other structures which will be apparent to those skilled in the art. While relatively fine features are preferred in the probe mesh, sufficient robustness to the incident electron current must be provided. Resolution of the system is maximized by the sensing of edges of features of the probe mesh. Hence, fine features are preferred to preserve beam current while providing a relatively greater length of feature edges. Transmissivity of the probe mesh 110 is preferably 90% or greater.

Please replace the second full paragraph on page 16 starting on line 26, with the following:

Q4

For mask making it is desirable that the step of patterning the fiducial grid on the mask be unintrusive as possible while providing maximum signal to noise ratio. A metal back scatter

Q4
End

potentially interferes with the mask processing and the signal to noise ratio is dependent on the relative back scatter coefficients and percent coverage of fiducial grid. For the scintillator approach in accordance with the invention, the signal to noise ratio is improved due to the absence of photon radiation off the fiducial grid. Such a material emits light when electrons are incident on it and the resultant light can be detected by a sensor such as a photo-diode or photomultiplier 180 (Figure 2) that may be placed at a location in the tool that does not interfere with operation of the tool or the lithographic exposure.

Please replace the first full paragraph on page 18 line 12, with the following.

Q5

While high transmissivity is preferred, these probe mesh dimensions are convenient since the shaping apertures are generally about 240 microns; yielding ten stripes in each coordinate direction. The number of stripes must be sufficient that at least one stripe remains in each coordinate direction after the beam is shaped by the shaping apertures. The stripe width must also not be so narrow that contrast in the shadow image 420 is significantly reduced by slight variations of electron trajectory in the beam. Perhaps more importantly, however, the range or displacement of the dither pattern must be only slightly less than the pitch of the probe mesh features, referred to the target plane, so that the shadow features will substantially cover the area of the shaped spot and the dither pattern must be executed within a time that is shorter than the exposure time for a projected feature. The dithering of the shadow image of the probe grid over the target stripes results in a signal which depends, in part, on the response time of the scintillator material. This signal must be within the bandwidth of the detector, including the response time